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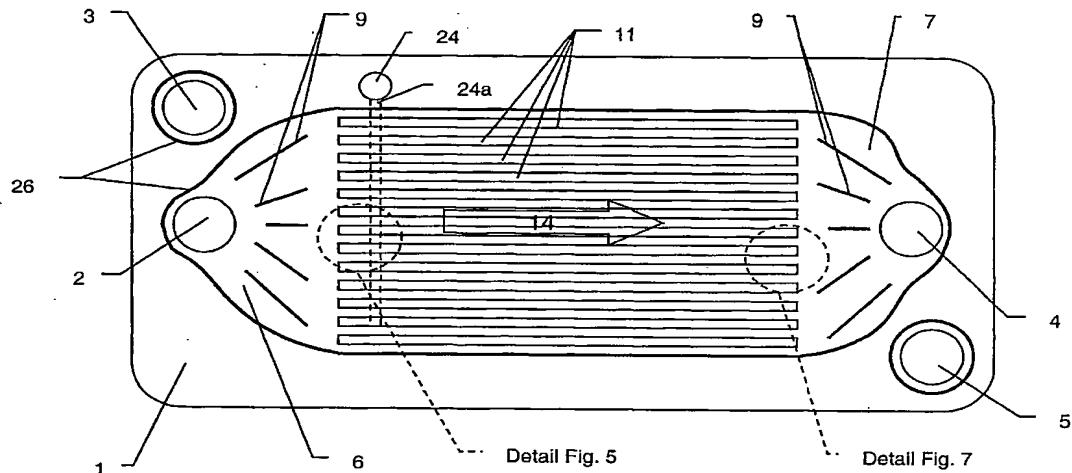
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[Fortsetzung auf der nächsten Seite]

(54) Title: MICROREACTOR COMPOSED OF PLATES AND COMPRISING A CATALYST

(54) Bezeichnung: MIKROREAKTOR IN PLATTENBAUWEISE MIT EINEM KATALYSATOR



**WO 2004/091771 A1**

(57) Abstract: The invention relates to a microreactor (1) composed of plates or stacks for carrying out heterogenically catalysed reactions for commercial use, said reactor being provided with chambers between the plates for the chemical reaction and the dissipation of heat. Catalytic material is applied to the internal walls or lies in recesses of the reaction chambers and spacer elements (11) are provided in all chambers. The invention is characterised in that the slot-type reaction chambers of the microreactor comprise channels with a hydraulic diameter of less than 1500 micrometers and a ratio of free slot width to free slot height ranging between 10 and 450.

(57) Zusammenfassung: Die vorliegende Erfindung offenbart einen Mikroreaktor (1) zur Durchführung heterogenkatalysierter Reaktionen in Platten- bzw. Stapelbauweise für den grosstechnischen Einsatz, wobei Plattenzwischenräume für die chemische Reaktion und für den Wärmeabtransport vorgesehen sind. In den Reaktionsräumen ist Katalysatormaterial

[Fortsetzung auf der nächsten Seite]



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(81) **Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart):** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

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**Veröffentlicht:**

— mit internationalem Recherchenbericht

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/EP2004/003377

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 B01J19/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 B01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>WO 98/37457 A (BREUER NORBERT ; MEYER HEINRICH (DE); ATOTECH DEUTSCHLAND GMBH (DE)) 27 August 1998 (1998-08-27)            abstract            page 9, line 9 - line 13            page 10, line 19 - line 34            page 25, line 5 - line 13; figure 5</p> <p>-----</p> <p>EP 0 903 174 A (BAYER AG ; KARLSRUHE FORSCHZENT (DE))            24 March 1999 (1999-03-24)            abstract            page 3, paragraph 11 - paragraph 14            page 4, paragraphs 21,29; figure 1            page 5, paragraph 33; figure 3</p> <p>-----</p> <p>-/-</p>	1-23
A		1-23

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

## \* Special categories of cited documents :

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- \*&\* document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 July 2004	26/07/2004
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax. (+31-70) 340-3016	Authorized officer  Thomasson, P

## INTERNATIONAL SEARCH REPORT

International Application No  
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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JANICKE M T ET AL: "The Controlled Oxidation of Hydrogen from an Explosive Mixture of Gases Using a Microstructured Reactor/Heat Exchanger and Pt/A1203 Catalyst" JOURNAL OF CATALYSIS, ACADEMIC PRESS, DULUTH, MN, US, vol. 191, no. 2, 25 April 2000 (2000-04-25), pages 282-293, XP004465467 ISSN: 0021-9517 abstract -----	1-23

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International Application No PCT/EP2004/003377	
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Patent document cited in search report	Publication date		Patent family member(s)	Publication date
WO 9837457	A 27-08-1998	DE	19708472 A1	24-09-1998
		CA	2282354 A1	27-08-1998
		WO	9837457 A1	27-08-1998
		DE	59809806 D1	06-11-2003
		EP	0961953 A1	08-12-1999
		ES	2205468 T3	01-05-2004
		JP	2001524019 T	27-11-2001
		TW	438624 B	07-06-2001
		US	6409072 B1	25-06-2002
EP 0903174	A 24-03-1999	DE	19741645 A1	25-03-1999
		CA	2247662 A1	22-03-1999
		EP	0903174 A1	24-03-1999
		JP	11171857 A	29-06-1999